Tonsils of slaughtered pigs as marker sample for salmonella positive pork

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Introduction

Pork is responsible for approximately 15% of all cases of salmonellosis in humans in Western Europe and North America (1). To reduce the prevalence of pork-borne salmonellosis in man, it is important that carcasses of slaughtered pigs and other edible pork products do not contain salmonella after the slaughter process. As long as it is not possible to avoid contamination of pork with salmonella, the contamination level should be as low as reasonably achievable. In order to reach this situation, contaminated carcasses should be identified, so that this meat can be processed (e.g. heated) to eliminate the safety risks. For this reason it can be useful to investigate a sample, which can be collected easily and is able to predict if salmonella is present on the carcass after slaughter.

The objective of this study was to determine which samples of slaughtered pigs can be used to predict the chance that pigs of a certain herd will contain salmonella on the carcass after slaughter.

Materials and Methods

In two Dutch pork slaughterhouses, 353 randomly selected pigs were sampled, over 3 sampling days per slaughterhouse. From each pig a blood sample was collected directly after stunning. During the slaughter process liver and tongue were swabbed with a diaper, after the pluck was removed. This swab method was first described by Van den Elzen et al (2). Further, from each pig the tonsils, 25 grams of rectal contents and mesenterial lymphnodes were collected. Carcasses were swabbed after they left the shock chiller. One half of each carcass was swabbed with a diaper on the back from the tarsus to the ear and on the belly from the tarsus to the nose.

Blood samples were centrifuged, and the resulting serum was investigated for the presence of antibodies against salmonella with an ELISA (3, 4). The other samples were investigated for the presence of salmonella by standard procedures (pre-enrichment 24 hours in buffered pepton water at 37°C, enrichment 24-48 hours in Rappaport Vassiliadis broth at 42°C, 24 hours on brilliant green agar plates at 37°C, confirmation of 5 suspect colonies per plate on triple sugar iron 24 hours at 37°C). To be sure that only real infections of the tonsils and lymphnodes were measured and no surface contamination, these organs were sterilized on the outside by keeping them 3 seconds in boiling water, before they were cut up with sterile material and added to BPW.

Results

Salmonella was isolated from 10 carcasses. When investigating the other samples of these 10 pigs, salmonella could be isolated from 7 tonsils, 4 feces samples, 3 lymphnodes, 2 tongues and 2 livers (table 1). ELISA of the serum samples resulted in 3 salmonella positive sera. A significant association between salmonella-status of the carcass and other samples was only observed for the tonsil (Chi square, $p<0.05$), with a relative risk of 6.0 (95% confidence interval 3.8-9.4). The predictive value of a salmonella positive tonsil for having a salmonella positive carcass was 8.5%. The predictive value of a salmonella negative tonsil for having a salmonella negative carcass was 98.5%.

A salmonella positive tonsil was also associated significantly with salmonella positive edible pork products after slaughter (positive carcass and/or liver and/or tongue (Chi square, $p<0.05$)). Positive serology results of individual pigs, and also the salmonella status of the herd (based on serology) to which a pig belonged, were not associated with a salmonella positive carcass, nor with salmonella positive edible products.

Table 1: Results of salmonella isolation from samples of pigs with salmonella on the carcass after slaughter.

Pigs with salmonella on the carcass after slaughter						
Pig number	Liver	Tongue	Tonsil	Feces	Lymph-node	Serology
1	-	-	-	-	-	-
2	-	-	-	-	-	-
3	-	-	+	-	-	-
4	-	-	+	-	-	-
5	-	-	-	-	+	-
6	-	+	+	+	+	+
7	+	-	+	+	-	+
8	-	-	+	-	-	-
9	+	+	+	+	+	+
10	-	-	+	+	-	-

Discussion

The results of this study show that carcasses of pigs with salmonella in the tonsil are more likely to contain salmonella after slaughter (6 times higher chance) than carcasses of pigs without salmonella in the tonsil. This means that the tonsil can be used as a marker for salmonella positive carcasses. If a test is available that can detect/isolate salmonella within 24 hours, the results of the tonsils can be used directly for selection of the carcasses and products of slaughtered pigs. If such a test is not available, the results of the tonsil can be used for identifying herds/farms/transport/lairage that can be considered as "risk chains", so that precautions can be taken when those chains deliver pigs to the slaughterhouse.

It was shown that a positive serology result of a pig or herd was not associated with salmonella positive carcasses or products. This means that the serology results cannot be used for predicting the salmonella status of the individual carcass after slaughter. Serology results can, however, provide us with valuable information about the input of salmonella from the farms into the pork production chain.

An explanation for the association between salmonella positive tonsils and carcasses may be the fact that both salmonella positive tonsils and carcasses are mainly caused by cross contamination, rather than by a longer existing salmonella infection of the pig. This also explains why we could not find an association between serology results and salmonella positive carcasses.

References

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